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success is evidenced by the remarkable fact that during the past twenty-two hundred years, ever since this irrigation work was built, there have been only six minor floods in the Plain.

The presence of innumerable other irrigation projects, greatly diversified in construction and surprisingly adaptable to the local topography and source of water supply, bears witness to the painstaking and extensive adjustments the Basin has made to the vital problem of water supply.

A second adjustment to water resource lies in the fact that even with its limited available technological knowledge, the Basin has made good use of many of its numerous streams. By canalization, damming, and other devices, the navigability of these streams has been greatly increased. Especially the successful negotiation by steamboats of the bottle-neck (gorges) of the mighty Yangtse has greatly tempered the continental position and the land-locked character of the Basin. These achievements, in turn, have facilitated the movement of the bulky agricultural and forestry products among the various areas both within and without the Basin.

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The localization of the Basin's urban units on the terraces and along the banks of the principal rivers is a third example of adjustment, partly to topography and partly to river transportation.

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Among the climatic adjustments, the architecture of the Basin (characterized by the projecting eaves, recurved roofs, and elaborate roof ornaments) is closely correlated to the absence of wind and snow and the extended misty rain-season of the Basin.

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The practice of digging in the soft, friable, cretaceous bed rock, in order to hasten weathering and soil formation for agricultural land use, represents one of the most astounding examples of soil culture and environmental adjustment in the Basin.

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As a result of the abundant growth of bamboo in the Basin, an interesting adjustment to vegetation has taken place. Nowhere else in China except in the Basin does one find widespread use of bamboo. In addition to the large number of articles of furniture, household tools, and utensils of various kinds which are made from this material, even the great engineering construction works, including the important irrigation systems, bridges, and brine-salt mining equipment are all made of bamboo. It was once estimated that bamboo is used for six hundred different purposes in the Basin. Here people are truly in the "bamboo age."

823 The Basin has often been referred to by western writers as "the Eden of the Flowery Republic," or the "Garden of Asia." By the Chinese themselves, it is popularly called the "Tien Fu," which literally means the "Treasury of Heaven." Although these
241 names may appear exaggerated, they do suggest the agricultural
433 richness and the amazing diversity of the products of the Basin. Normally, Szechuan Basin leads all China in the production of corn and rape. It holds second place as a producer of rice, potatoes, and silk; fifth place, as a producer of wheat; and sixth, as a producer of millet, kaoliang, and soy beans. The Basin has been for decades unchallenged as a producer of such internationally known products as tung oil, bristles, herbs, Cho Tsai (pickled vegetables), Wu Pei Tze, and Nanmu (lumber).

The agricultural richness of the Basin and the important role it now plays in China's present war effort are demonstrated by one significant fact. The Basin alone contributes about 60 per cent of the total food supply for the entire Chinese fighting force, comprising over five million men. The Basin is truly a granary of all free China.

●314 In forestry land use, the Basin normally produces about
433 a third of the total annual production of tung oil for all China. This product constitutes a critical cash crop for farmers in many parts of the Basin, particularly in the hilly east and southeast. At present tung oil occupies a vitally important position in the export trade of the Basin. It, alone, comprised about 65 per cent of the Basin's total export trade in 1940.

[388] Another important forestry product of the Basin is white wax. The Basin normally produces over 90 per cent of the total white wax of China. Although the economic value of this unique forestry product is not great, the spectacular snow-white color of the wax tree in the late Autumn adds much to the picturesqueness of the Basin's agricultural landscape.

[386] Lacquer derived from the varnish tree, has been famous in the Basin ever since the Han dynasty (206 B.C. to 220 A.D.). It still remains one of the Basin's most reputed products.

135 The variety and abundance of strategic minerals in the Basin is second only to its richness in agricultural and forestry products. Today the Basin leads all China in the production of brine salt. Its iron reserve ranks second and its coal reserve ranks third in the country, but it is at present the leading

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722 As a result of the recent barbaric Japanese invasion of China and the great influx of modern people and ideas from down-river into the Basin during the past few years, a renaissance has begun in Szechuan Basin. The Basin is now undergoing an economic awakening. It is in a state of rapid transition, induced and intensified by the exigencies of the war.

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654 Since the migration of the National government into the Basin, every possible means has been utilized and every feasible
241 plan is being drawn up to increase the efficiency of land use in the Basin. Mention may be made of a few striking examples.

In agricultural land use, various measures have been devised to cope with the inefficient traditional Tung Shui Tien field system; the acreage in Tsai Seng Tao variety rice has been extended; cotton culture has been expanded; the cultivated acreage of herb plants has been increased; more modern sugar refineries have been built, experimental stations have been established, and a number of new varieties of sugar cane have been introduced; silk-culture has been organized and operated on a more scientific basis; a number of tea-growers' cooperatives have been found recently; and above all, the practices in fertilization, terracing, erosion control, and irrigation works have been improved.

178 With the introduction of more modern methods of processing, the numerous agricultural and forestry products of the Basin are being put into more efficient utilization. The increasing manufacture of alcohol and wines from grains, the making of charcoal from wood, and the preparation of synthetic gasoline from tung oil are notable examples. These innovations not only meet the various emergent war needs, especially that of fuel supply, but also help to solve the still difficult transportation problem by transforming the bulky agricultural and forestry products into lighter and more transportable forms.

313 In forestry land use, significant improvements have already taken place. A number of large corporations, financed either by government or private interests, have recently organized to survey intensively and to exploit systematically the rich forestry
314 resources of the Basin. Numerous attempts have been made to improve tung tree production, including the establishment of more tung tree plantations and experimental stations, the supply of modern equipment, and the efficient organization of marketing facilities. Besides, the recent completion of the west branch of

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the Szechuan-Yunnan highway will relieve to a considerable degree the traditional difficulty of transporting the wax insects for the white-wax tree industry.

In both mining and manufacturing, rapid progress has also been made. During the past few years, the Basin's coal production has been increased 400 per cent, iron production 300 per cent, and placer mining 200 per cent. Besides, the Basin is rapidly developing into a new industrial center of free China. It is now the home of over 61 per cent of free China's machine industry. At present the Basin accounts for about 40 per cent of the total manufacturing capacity of all free China.

Even in the most chronic and difficult problem of transportation land use, rapid progress is being made. Numerous commercial air lines have been inaugurated since 1932, many railways (some of them already under construction) have been projected; and the highway network of the Basin has been partly completed. Of the Basin's 136 districts, 85 districts, or 62 per cent, now have highway connections. Most important of all, the various projects for canalization of the numerous streams in the Basin have been vigorously advanced. Many of these projects (such as the Chi and Upper Chialing rivers) have already been completed. These achievements and many more to follow will make a long stride toward the satisfactory solution of the Basin's acute transportation problem.

As to the future development of the Basin, one may approach the problem from two standpoints: first, the future prospect of the Basin as a base of operation against the Japanese invasion; and second, the future position of the Basin when peace returns once more.

As regards the first objective, the future of the Basin is bright. First of all, here, in Szechuan Basin, one finds a unique geographic region which has the interesting and fortunate combination of a mild south-China climate (with a long growing season), a rich north-China mineral resource (particularly coal and iron), a Yangtse Delta agricultural wealth, and above all, a southwest-China rugged mountain topography which provides protection against military invasion. The agricultural richness of the Basin is particularly important in maintaining a sustained self-sufficiency and should enable the region to hold longer against invading forces than would otherwise be possible.

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[End map 10(a)]

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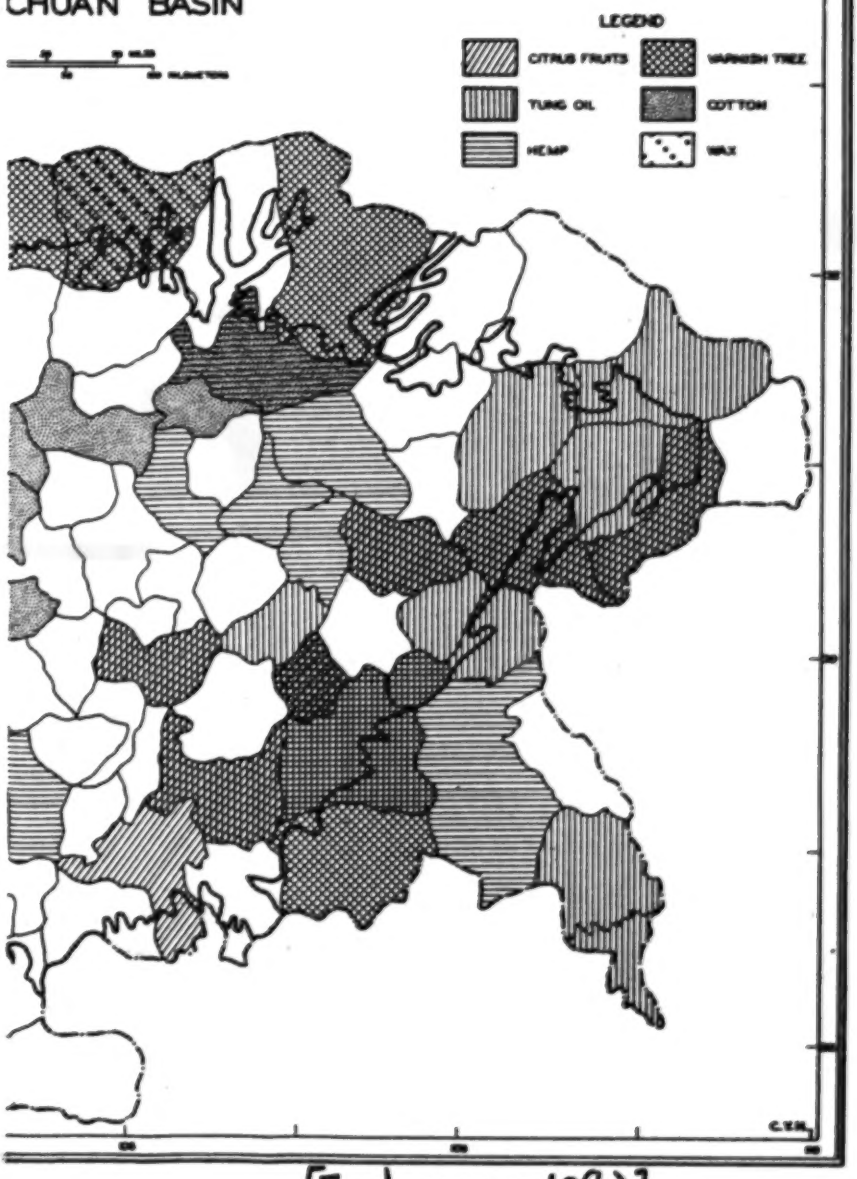
AND FORESTRY PRODUCTS
CHUAN BASIN



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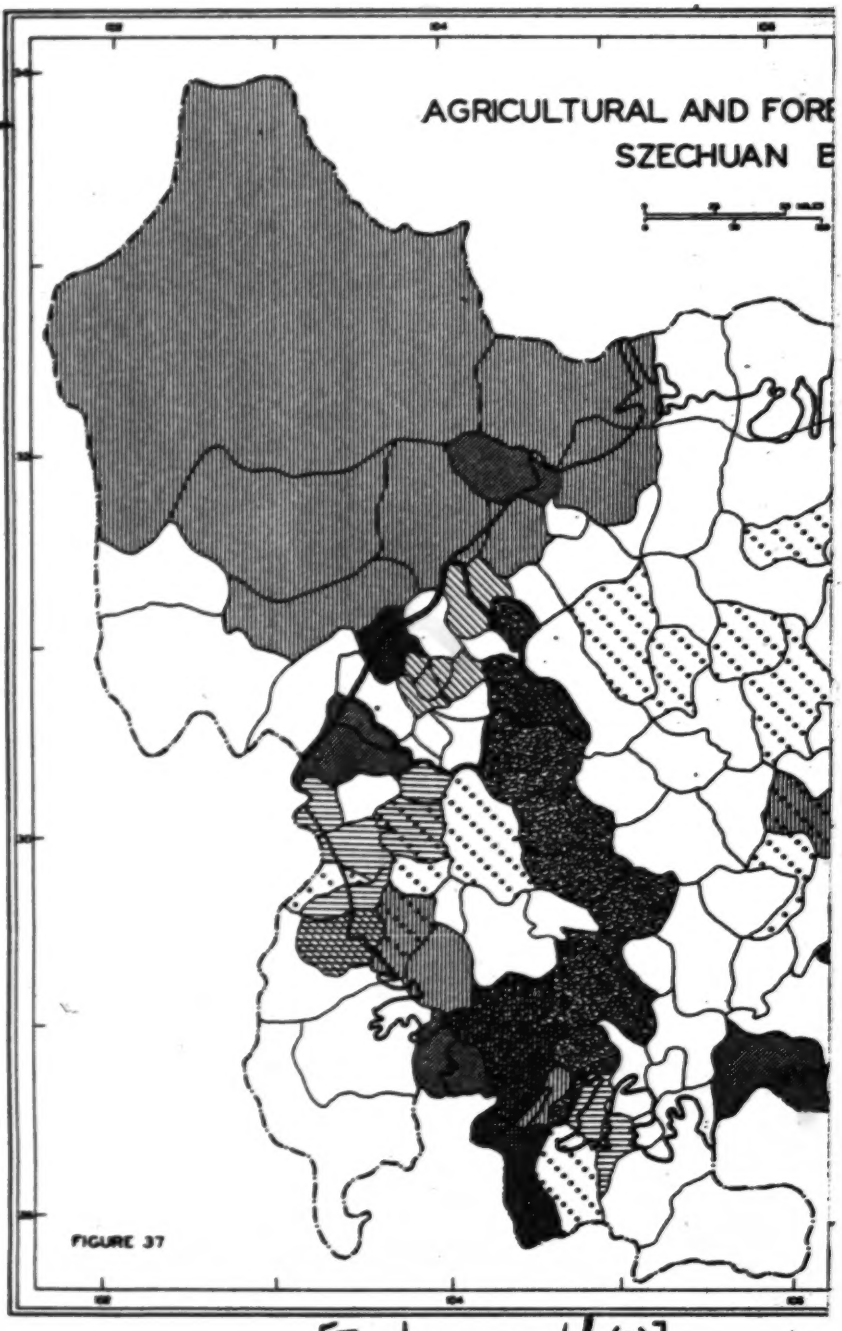

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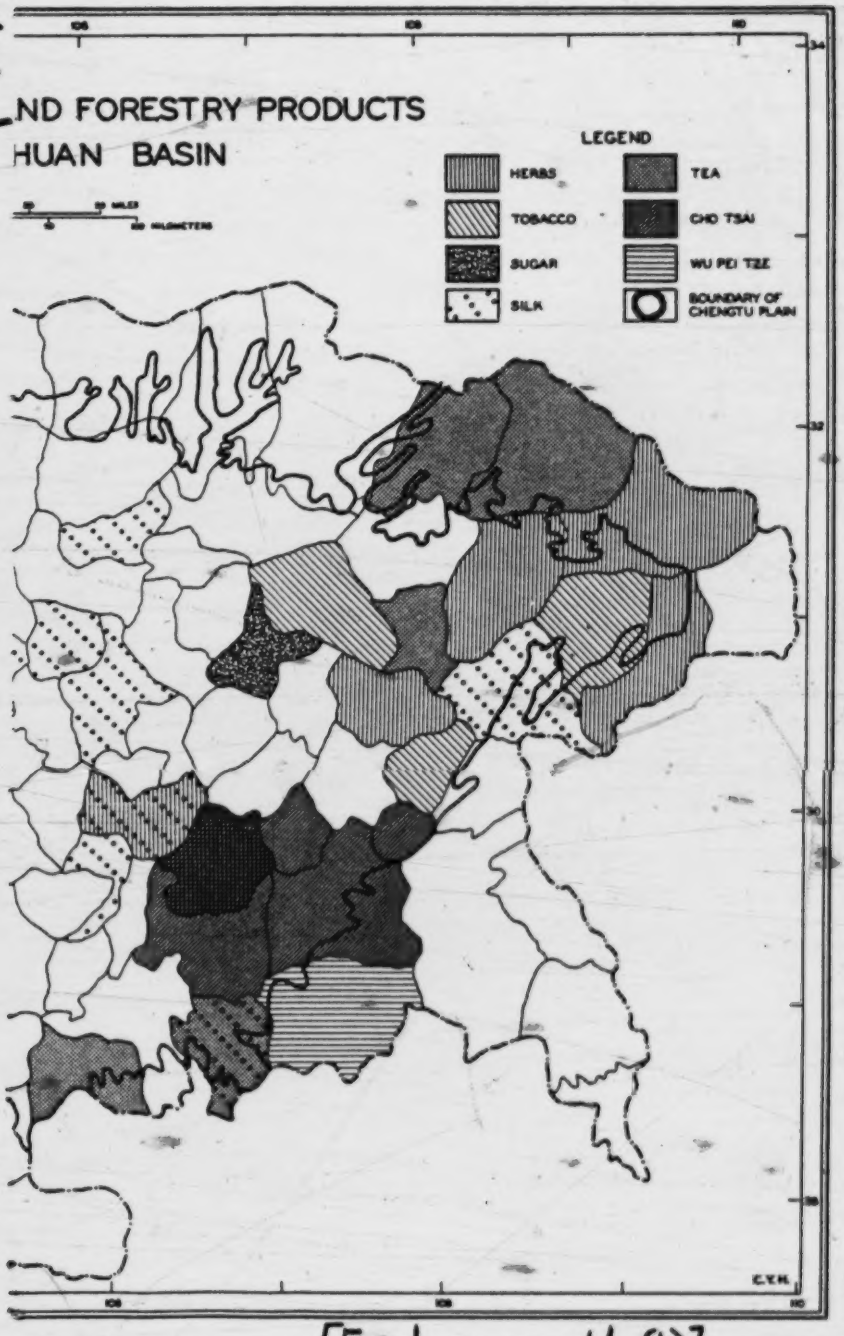

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311 Moreover, on account of the high ground water-tables here, the drainage conditions on these trough lands are very poor. These trough lands are sometimes used for wheat, hemp, rice, rape, or kaoliang, depending upon water conditions. But the productivity of these marginal agricultural lands are, in general, very low.

The second principal source of agricultural land-use here is developed on the more gentle slopes of the numerous synclines in this area. Here the slopes are terraced into rice, wheat, or potato fields. The drainage conditions are, in general, better than those in the trough lands of the anticlines. Considerable portions of the cultivated fields are used for Ta ma (hemp) and Tso Tsai (vegetable) cultures which are the two most spectacular agricultural products of this area.

• 314 The most outstanding feature of this agricultural area, as its name suggests, is the predominance of the forestry product, the tung oil. On the steep slopes or at the edge of the anticlines, where the soils are extremely shallow, great numbers of tung trees are planted. Especially during the past decade, stimulated by the increasing demand, the plantation of tung trees has been grown in leaps and bounds. This area alone now contributes about three-fourths of the total production of tung oil production of all the Basin. In one district, Ning-shui alone, it produces about 52 per cent of the total tung tree production of the Basin. This factor has increased greatly the population-support capacity for this agricultural area and also helps to explain the presence of a few detached high population density areas here (Fig. 10).

135 Another interesting characteristic of this agricultural area is that here lies about 65 per cent of the total coal reserve (Pa-hsien and Chiang-peh) and about 45 per cent of the total iron reserve (Chi-chiang and Nanchuan) of the whole Basin.[1] This remarkable fact suggests that in the future days to come, this agricultural area may abandon its present modest pursuits in agricultural and forestry production, and will soon take an unchallenged leadership in the growing industrial and manufacturing development of the Basin.

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[1] W. C. Cheng, "The Iron and Coal Resources of Szechuan," Szechuan Monthly, V, No. 5 (1934), 35.

7: Hu K-5 (1934-) 1946 AF16 Southwest China AF16

137 it wonderfully well into the general topography, soil, and climatic conditions of the Basin.

2. Principal Producing Areas

314 137 The Tung trees grow over wide areas of the Basin, but the three principal producing regions are: (1) the Yangtse area, including Ning-shui, Yun-yang, Wan-hsien, Kai-hsien, Chung-hsien, and Feng-chieh districts; (2) the Chien and Chi River areas, including Yu, Siu-shan, and Pei-ling districts; (3) the Chialing River area, including Ho-chuan and Pa-hsien districts (Fig. 36). Among them, the Yangtse Valley area, especially the districts near the anticline belt, is by far the most important.

[433] The total annual production of tung oil is estimated to be about 760,000 piculs.[1] In 1936, Ning-shui, one of the districts which makes up the first of the three principal producing areas, led all the districts with a total annual production of 180,000 piculs; Chung-hsien, of the same producing area, in the second place, produced 140,000 piculs; and Yun-yang produced 100,000 piculs (Table 13).

The Tung trees (Aleurites fordii) which grow in the Basin are of two kinds--Chai tung, or fuel tung, and mi-tung, or rice tung. The Chai tung is taller in height, generally around 20 to 25 feet, and has rougher and larger branches. The fruit contains fewer seeds (only three to five) than the Mi tung, and thus has less oil content. Hence, very few Chai tung trees are planted here.

The Mi tung tree, the major kind planted in the Szechuan Basin, is shorter in height (about 15 feet or less) and is highly ornamental in flower and foliage. The flowers, produced in great profusion during April, are usually white, stained with pink and yellow markings. These are followed always by green apple-like fruits, which are hidden among the large, glossy, heart-shaped leaves and generally ripen between August and September. Each fruit usually contains five to seven seeds. The Tung trees begin to bear fruit in their fourth year, and their period of

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[1] C. S. Chang, The Tung Oil of Szechuan (Ming Seng Co., 1936), p. 18. But the most recent report gave the total acreage of Tung tree for 1940 as 1,150,000 mow and with an annual production of 1,140,000 piculs (cf. Yen, op. cit., p. 31). This is, of course, a little unusual and is due to the war time boom production.

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greatest production is from the eighth to the sixteenth year. A decline in productivity begins with the seventeenth year. Thus there is a local saying, "The seventeenth year is the limit for the Tung Tree." 314 137

The tung seed-collecting season varies from locality to locality in the Basin, but, on the whole, comes in the middle of September. After the green fruit is picked, it is piled into heaps and covered with straw or grass. The heat thus generated quickly rots the fleshy part of the fruit and the seeds are removed. They are then roasted,[1] ground, steamed, and pressed, like other oil-producing seeds. All of these processes are done with very simple equipment and at low efficiency. The roasting and steaming are done by burning of charcoal or coal, whereas the pressing and grounding are all done by animal power. The product, which amounts to about 40 per cent of the weight of the seed, is a brown and somewhat watery oil. It is sent to the nearby local plants for refining, and then packed in wooden tubs and bamboo baskets to be shipped down the Yangtse to Shanghai for export abroad.

In the economy of the Szechuan Basin the Tung tree figures as a natural mountain product. Usually, the trees are left to grow wild; very little attempt is made by the farmers to cultivate them. Only during recent years, following the continuous success in the export trade, have a large number of Tung tree plantations and nurseries been organized and scientific methods applied to cultivation and production. The best known plantations are the I-shui at Wan-hsien, and the Jen-ho at Pi-shan. Each comprises from 200,000 to 300,000 trees. Both have met with phenomenal success during the past few years. An increasing number of such plantations, sponsored either by the government or by private interests, have recently been organized.[2] 245

3. Transportation and Marketing of Tung Oil

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The present war has greatly stimulated the production of tung oil in Szechuan and has brought drastic changes in the

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[1] Roasting is, however, not essential and is not practiced by all farmers.

[2] Chao, op. cit., p. 21.

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314 marketing and transportation of the product. Prior to the war, Wan-hsien, between Chungking and Hankow, was the most important shipping center for Szechuan tung oil, as well as other products. 314 439 Its importance was due to its geographical location on the main waterway to Shanghai via Hankow. But, however, since the fall of Wu-Chang-Hankow tri-cities and consequently the close of the gorges route to the east due to the enemy's blockade, this route of transhipment of tung oil has been greatly shifted. Now, Chungking, because of its new political importance and because it is the starting point of new highways in southwest China, has become the most vital concentration point and the sole exporting center of tung oil. While in 1935-36 the oil sent to Chungking for transhipment (totaling 150,000 quintals) was only three-fourths that sent to Wan-hsien, the 1938 figures for Chungking showed an increase to 350,000 quintals.[1] The amount sent to Wan-hsien, on the other hand, dropped to 150,000 quintals,[2] only a little over one-third that sent to Chungking. Districts that formerly sold their oil through Wan-hsien now turn their products over to the purchasing agents of the Foreign Trade Commission at Chungking.[3] This newly created concern, with the cooperation of both government and private interests, collects the processed oil and exports it abroad by way of the Kweichou-Szechuan highway (Fig. 18) through the back door of China.

In 1938, 42.9 per cent of the local oil came from points east and south of Chungking, 24.4 per cent from places along the Chialing and Chu rivers, 14.2 per cent from the Chien and Wu River valleys, 17.1 per cent from points along the Yangtse above the city of Chungking, and the remaining 1.4 per cent from other places.[4] This kind of tung oil concentration and shipment is consistent with the general patterns of its production, because the principal tung-oil-producing areas, as already mentioned, are concentrated in the districts both north and south of Chungking, and in the upper Chialing and Chien River Valley areas.

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[1] Foo-hsing Trade Corporation, Trade Report (1939), p. 32.

[2] Ibid., p. 34.

[3] Ibid., p. 38.

[4] Ibid., p. 41.

7: Hu K-5 (1934-) 1946 AF16 Southwest China AF16

Tung oil is widely used in the modern industrial world. 314
It has been proved particularly invaluable in making high grade paints, in boat-building, and in the manufacturing of many other water-proof products. The refuse cake, chemically a complete 387
fertilizer, is valued highly by the farmers of the Basin for fertilization purposes. It is used especially for the dry crop 314
fields, such as corn, kaoliang, and other crops, but is very seldom applied to the rice-fields. It is reported that these tung-cake fertilizers are particularly suitable to the corn crop.[1] [388]
The shells of the tung seed, together with rice and soy bean stalks, burned and treated, are commonly used to prepare a cheap soap for the local farming families.

China now produces about 85 per cent of the total world 439
supply of Tung oil, and the production of Szechuan Basin alone 314
accounts for about 40 per cent of the total tung oil export of all China. The best customer was the United States, which, before the war, took on an average about half of the total production. Other customers were Germany, with about 25 per cent of the total; England, with about 15 per cent; and France, Italy, and Japan, each with about 5 per cent of the total annual export.

From the standpoint of the agricultural economy of the Basin, the production of tung oil is vitally significant. Even apart from the huge amount of cash income it brings in the export market, the value of the refuse cake for fertilization, and other industrial purposes, such as the manufacturing of soap, the total value of the Tung tree to the farmers of the Basin is incalculable. Hence, the Bureau of Agricultural Research of Szechuan has recently launched an ambitious ten-year expansion program to boost the Basin's Tung-tree production. It aims to increase the present yearly production of oil from 400,000 quintals to 1,000,000 quintals. At the same time, the Foreign Trade Commission together with the Ministry of Agriculture and Forestry have a five-year plan for increasing tung-oil production in Szechuan, Hupeh, Hunan, Kweichow, and Kwangsi to 650,000 quintals per year. In addition to existing Tung trees, according to the five-year plan, Szechuan is to plant Tung trees on an additional 500,000 mow of land as a necessary step in the expansion program.[2]

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[1] Y. J. Hsiao, "A Study of the Agricultural Practices of Szechuan," Reconstruction Weekly, IV, No. 7 (1933), 6.

[2] Bureau of Agricultural Research of Szechuan, Annual Report (1940), p. 76.

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equipment, and the standardization of the finished product are most important.[1] 000

Recently, realizing the necessity of such improvements, the Bureau of Agricultural Research of Szechuan has established four model Tung tree experimental stations at Pei-ling, Nan-chung, Ning-shui, and Wan-hsien districts in order to direct the essential improvement work. With the author's experience among the tung farmers in the Basin, he feels strongly that it is probably wiser for the Agricultural authorities here to carry on the improvement work along the lines suggested above rather than aiming merely to boost the present acreage. Successful modern commercial agricultural production means high quality, as well as quantity. It would be heart-breaking to witness the same tragic fate befall the Tung tree, generously favored as it is by the Basin's physical conditions, that befell China's silk and tea. Nature has already done her part, and it is now up to man to do his. 314 654

C. The Wax Tree Production

1. The White Wax Tree

White wax, produced by the secretions of tiny insects, locally known as Pai-lou-chung (Coccus pela), on a number of wax trees or shrubs, is another unique forestry product of the Szechuan Basin. The so-called wax trees or shrubs consist of over ten species, including both conifers and broad-leafed hardwoods. One particular species of conifer, locally known as Pai-Lou-Shu (Fraxinus Chinensis), is the most important and the most common species on which the wax insects are raised. 314

There are two main species of wax insects: Shan Ti Tsung, or the hilly insects, including breeds produced in Hui-li, Hsi-chang, Ning-yuan,[2] and Kuan-hsien districts, and Pa-Tsung, or insects of the plain areas, including breeds produced in O-mei, Lo-shan, Chien-wei, and Hung-ya districts (Fig. 36). Generally speaking, the plain insects are inferior in quality and are not used for breeding purposes. Also, it is reported[3] that in the 136

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[1] Chao, op. cit., p. 24.

[2] Hui-li, Hsi-chang, and Ning-yuan districts are now under the jurisdiction of Sikang province.

[3] Ho, op. cit., p. 15.

7: Hu K-5 (1934-) 1946 AF16 Southwest China AF16

237 is its high melting point--83 degrees centigrade. It is said that Thomas Edison used this white wax from Szechuan Basin to make his first gramophone records, which have since given pleasure to so many people in all parts of the world.[1]

2. Yellow Wax Production

In addition to white wax, the Szechuan Basin also produces a considerable amount of yellow wax from bee hives. According to Buck, Szechuan farmers lead all China in the average number of bee hives per farm.[2] They are particularly important in the districts of Kuang-yuan and Kuan-hsien, in the north and west of the Basin (Fig. 36). The total production is generally estimated to be around 34,000 piculs, with Kuang-yuan, as the leading producer, accounting for a fourth of the total production. The yellow wax, like the white, is used mainly for candles, furniture polish, models, and many medicinal purposes. But, unlike the white wax, it is consumed principally within the Basin.

D. The Varnish Tree Production

•314 Lacquer and lacquer wares in Szechuan have been famous ever since the early Han dynasty. The main producing areas are in the districts of Kuang-yuan, Chao-hua, and Tung-chiang, to the north, and Nan-chuan to the south (Fig. 36). The northern areas are the most important. The total annual production is approximately 4,000 piculs.

The varnish is obtained by tapping the stems of the tree (Rhus vernicefera), locally known as Tsi Shu, by making horizontal incisions in the bark. Generally, these incisions are first made and the tapping begun when the tree is seven years old and has attained a diameter of six inches. Two years are allowed to elapse before the same tree is tapped again. The tapping season commonly begins in late June or early July, at the time corresponding with the opening of the flower, and continues throughout the summer. The sap, as it is exuded, is pure white in color, but quickly oxidizes to a grayish-white, and finally to black. To prevent this oxidation, the crude varnish is covered as soon as possible with layers of oil paper.

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[1] Ibid., p. 17. [2] Buck, op. cit., p. 248.

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Prior to the war a major portion of the raw varnish, about 90 per cent of the total, was exported to Japan. But now it is largely consumed within the Basin for manufacturing numerous lacquer wares, for which the Basin is famous in China. 314

E. General Conclusions

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The discussion of the agricultural and forestry land-use of the Szechuan Basin in the foregoing chapters has revealed in sharp relief three significant facts, namely: First, the dominance of the agricultural and forestry land-use in the general economy of the Szechuan Basin is not only the most striking fact but the most illuminating concept in the geography of the Basin. The very fact that the Basin has the greatest diversity of agricultural products and is almost a miniature China in agricultural production typifies its extreme agricultural richness. Moreover, the astounding figures that about 85 per cent of the total population is engaged in agricultural pursuits and over 60 per cent of the Basin's export is derived from one single forestry product, the Tung tree oil, demonstrates clearly the ever-close bond between the well-being of the people in the Basin and its agricultural and forestry land-use. In addition, it is recently revealed that the Basin supplies about 60 per cent of the total food supply for the entire fighting force of China, comprising well over five million strong. This single fact alone bears witness to the vital part the Basin now plays in China's total war effort. Among other things, this rich agricultural and forestry production of the Basin is undoubtedly one of the most important factors, perhaps the determining one, which has induced the National Government of China to select the Szechuan Basin as the principal base of operation against the present invasion.

The second conclusion deserving special attention is the close correlation of the Basin's agricultural and forestry land-use to its environmental factors. The adjustments of agricultural practices to physical environment here are both genuine and many. To mention a few striking examples, the minute terraced fields, the intricate irrigation systems, the wide range and great diversity of agricultural and horticultural products, the numerous practices in soil culture and crop rotations, and the wide use of bamboos are related respectively to the topography, water supply, climate, soil, and vegetation of the Basin. Especially the lack